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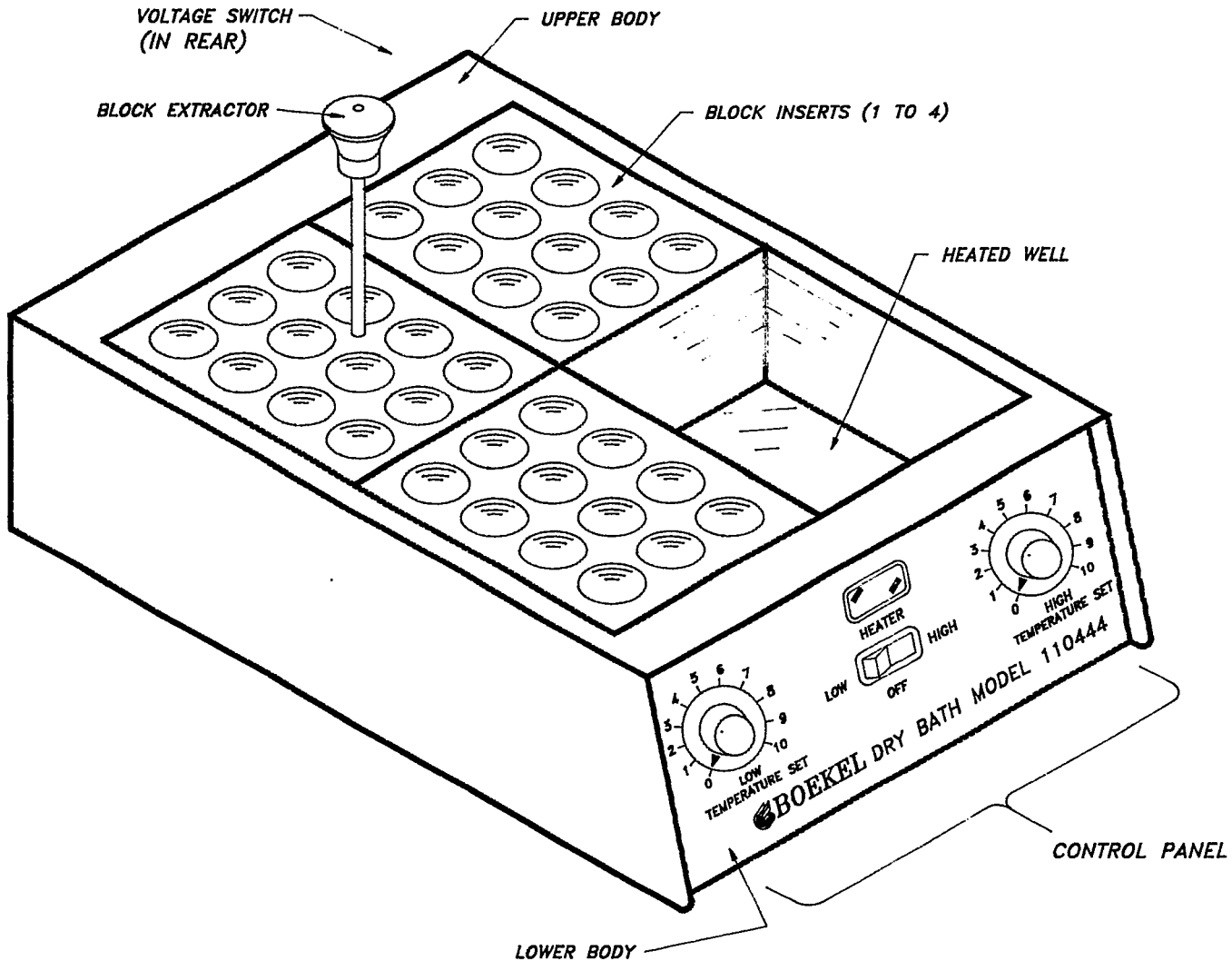
INSTRUCTION & MAINTENANCE MANUAL

DRY HEAT INCUBATOR
MODEL #110444



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DRY HEAT INCUBATOR
CATALOG NO. 110444

1. Introduction

It is important that these instructions be completely read and all operators acquainted with the units' operation before attempting to use it. Specific precautions will be noted together with maintenance requirements to insure safe and trouble-free operation. **DO NOT - UNDER ANY CIRCUMSTANCES - ALTER OR MODIFY THIS EQUIPMENT.** Such action will not only void the warranty but may create a hazardous condition leading to operator injury or equipment failure.

This incubator is intended to provide an accurate and reliable source of dry heat which will maintain block inserts containing test tubes at a controlled temperature. It is designed to operate over a temperature range from slightly above ambient to 125 °C.

Its clinical and general chemistry uses include incubation, culture inactivations, enzyme reactions, melting and boiling points, plus a wide variety of routine heating applications.

2. Equipment Description

The cabinet of the incubator is made of steel with a baked enamel finish. The block inserts are aluminum with a black anodized finish for superior heat uniformity. Each cabinet contains a recessed heated well into which the blocks are inserted. The heated well is insulated on all sides to minimize heat loss.

The heater assembly forms the bottom of the heated well. The heater element is an encased resistance type which is affixed to the underside of the heater plate which supports the block inserts. This heater has very uniform watt density to evenly distribute heat to all the blocks.

Temperature control is provided through the use of two bimetallic thermostats. One controls the "LOW" range of temperature from slightly above ambient to approximately 60 °C. One controls the "HIGH" range of temperatures from 50 °C to 125 °C.

A three position power selector switch is provided so that "LOW" or "HIGH" range operation may be used. The third position is for "POWER OFF". A voltage selector switch is also provided so that either 115V or 230V operation may be selected.

This incubator will accept from one to four block inserts. Although it will perform regardless of the number of blocks in the well, it is recommended that all four blocks be inserted to

optimize temperature uniformity. Incubator Model #110444 is provided with three blocks having 12 openings for tubes up to 16mm in diameter and two blocks having 12 openings for tubes up to 13mm in diameter. Other blocks with different numbers of openings for other tube sizes are available as optional accessories.

3. Specifications

Dimensions, capacity, weights and power requirements of the #110444 Dry Heat Incubator are listed below:

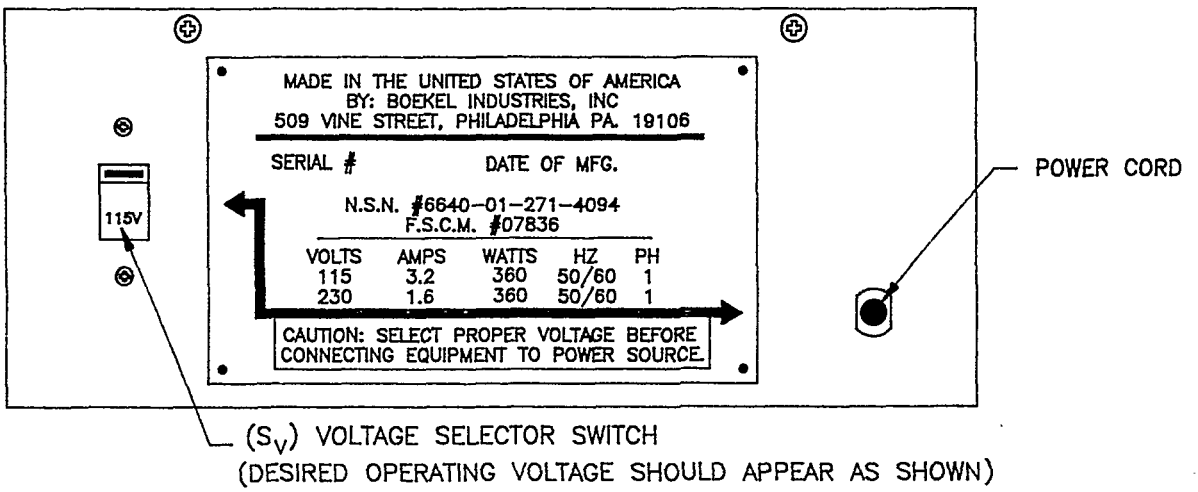
Temperature Range (°C)	Ambient to 125
Exterior Size (inches), WxDxH	8 x 13 x 3 1/2
Heated Well Size (inches), WxDxH	6 1/8 x 7 5/8 x 2
Block Size (inches), WxDxH	3 x 3 3/4 x 2
Capacity (# of Blocks)	1 to 4
Net Weight, Body (lbs.)	6 1/2
Net Weight, Block (lbs.)	1 3/4
Shipping Weight, Body + 5 Blocks (lbs.)	18
Max. Power Required (Watts)	360
Max. Current (Amps)	3.2 @ 115 Volts 1.6 @ 230 Volts

Notes: (1) Units operate equally well at either 50 or 60 Hz.
(2) Units are equipped with Voltage Selector Switch for operation at either 115V or 230 V.

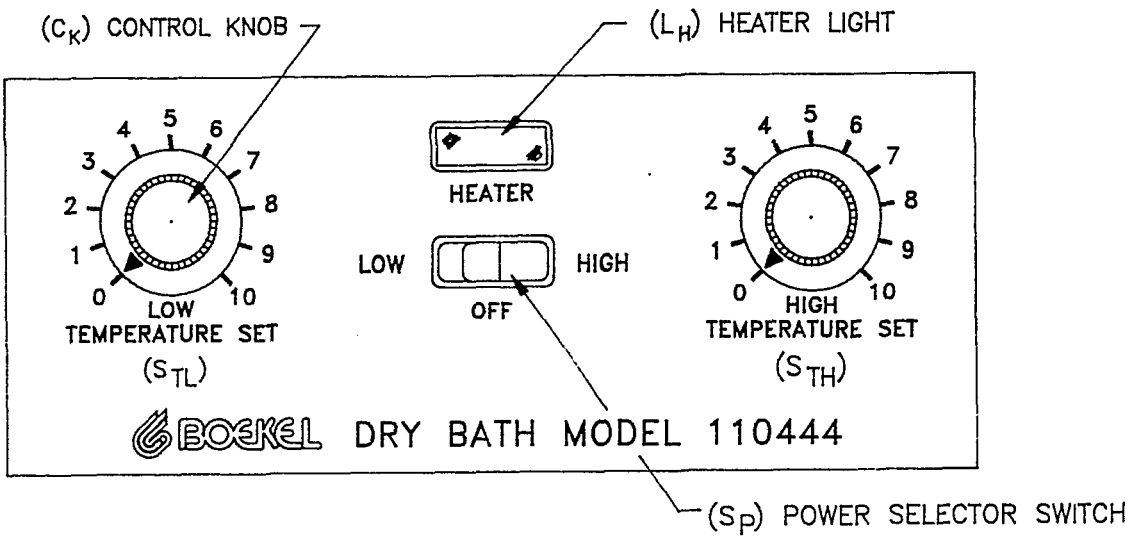
4. Features and Controls

The entire operation of the incubator is dependent on only four simple controls together with an indicator light.

The first control to be set by the operator is the voltage selector switch located at the rear of the body. It should be set to match the power supply to be used and is illustrated in the **"REAR VIEW"** shown below:



The remainder of the controls are located on the front panel of the incubator as illustrated on the **"FRONT VIEW"** shown below.



The Power Selector Switch directs power through either the "LOW" temperature thermostat or the "HIGH" temperature thermostat. Its center position is "OFF".

Each of the two thermostats has its own temperature control knob. It has a graduated reference scale (0 to 10) for correlation with desired block temperatures. Note: The numbers on the reference scales do not represent actual temperatures in °C but are useful for approximating desired set points.

The Heater Light will glow (red) when the heater is turned "ON". A regular cyclic period of alternate "ON" and "OFF" of this light indicates that temperature equilibrium is being maintained in the incubator. A steady "ON" condition will be observed during the heat-up period from ambient temperature to the desired control temperature.

5. Installation

For best operating results, the incubator should be operated in a draft-free location where ambient conditions are not subject to rapid change.

Be certain that a properly grounded power source of proper voltage and current carrying capacity is available.

CAUTION: SET THE VOLTAGE SELECTOR SWITCH ON THE INCUBATOR TO MATCH THE POWER SOURCE BEFORE INSERTING POWER CORD PLUG.

The incubator is provided with a three wire power cord with a three prong hospital grade plug.

CAUTION: DO NOT, UNDER ANY CIRCUMSTANCES, CUT OR REMOVE THE THIRD (GROUND) PRONG FROM THE POWER CORD PLUG. DO NOT USE A TWO-PRONG ADAPTER PLUG.

It is recommended that block temperatures be set and monitored through the use of an immersion type thermometer (not provided with the incubator). This thermometer, covering the desired temperature range, may be inserted into the thermometer well in the heating block. For more accurate temperature readings, the thermometer should be inserted into either the vessel being heated or a "test" vessel next to it.

Particularly at elevated temperatures, an even more accurate reading will be obtained by using a thermometer made with the immersion reference line level with the top of the block or the top of the contents of the "test" vessel. A thermometer marked at 35mm will be correctly immersed to the top of the block.

6. Operating Instructions

With the Power Selector Switch in the "OFF" position and both Temperature Control Knobs set at "0", the power cord may be plugged in a proper receptacle.

CAUTION: VOLTAGE SELECTOR SWITCH MUST BE SET TO MATCH THE POWER SOURCE VOLTAGE.

Place desired number of Block inserts into the heated well of the cabinet. Before inserting test vessels into the Blocks, bring the operating temperature of the Blocks to the desired value. this is done by first selecting either the "HIGH" or "LOW" position of the Power Selector Switch.

Rotate the Temperature Control Knob from "0" in a clockwise direction to the desired setting. To determine what block temperatures may be expected for various reference scale settings, allow the block temperature to stabilize at each of several scale settings for both the "HIGH" and "LOW" range controllers.

For approximation purposes, you will attain a block temperature of 38°C at a setting of "5" on the LOW range control, while a setting of "5" on the HIGH range control will produce a block temperature of 68°C. to reach a block temperature of 100°C will require a setting of "8" on the HIGH range control.

Having once determined the incubator temperatures vs. control set points, it is not necessary to repeat this process for subsequent applications. You may immediately select the proper HIGH or LOW range and set the control knob. You should, however, continue to monitor block temperature by means of an immersion thermometer and make minor adjustments to the control set point as required.

With Block temperature stabilized at the desired value, the vessels to be heated may be inserted into the Blocks. If your process permits, the vessels could be inserted at the start of the heating cycle and they will heat up at the same rate as the Blocks.

CAUTION: TO AVOID DANGER OF FIRE AND/OR EXPLOSION, DO NOT HEAT MATERIAL IN VESSELS ABOVE ITS AUTO-IGNITION TEMPERATURE.

When the heating process is completed, place the Power Selector Switch in the "OFF" position and remove plug from the power source. If it is expected that the next heat process will be at the same operating temperature, you may leave the Temperature Control Knob in its existing position. Otherwise, restore the Knob to the "0" setting.

It is important to be aware of the many variable factors which change the heat requirements of a Dry Heat Incubator, thereby affecting its heat-up rate, control point temperature and accuracy in maintaining desired temperature. The first and most obvious factor is operator error. Inattention to test conditions will seriously detract from the performance of any laboratory instrument and the Incubator is no exception.

Among the many significant factors are such things as the number of Blocks used; the number, type and contents of the vessels placed in the Blocks; and changes of ambient temperature or air velocities. An often overlooked variable is the effect of changes in the line voltage supply. Since heat output is a function of the square of the voltage, small changes of the supply voltage can have a significant effect on the unit.

7. Equipment Care

The basic design and construction of the Dry Heat Incubator reduces the regular care of the unit to one primary consideration - cleanliness. Be sure to set the Power Selector Switch in the "OFF" position and unplug the unit before performing any maintenance repairs or service.

CAUTION: THE UNIT SHOULD BE ALLOWED TO COOL TO NEAR ROOM TEMPERATURE BEFORE HANDLING HEATED BLOCKS OR TOUCHING HEATED WELL OF THE CABINET.

The Blocks may be washed in hot soapy water with a soft cloth. Holes in a Block can be cleaned using a test tube brush. The Blocks may be submerged in hot water without damage. After washing, rinse and wipe dry.

CAUTION: DO NOT USE SHARP OR ABRASIVE CLEANING TOOLS WHICH COULD SCRATCH THE ANODIZED SURFACE OF THE BLOCK.

Cleaning of the cabinet exterior and heated well area should be limited to wiping with a damp cloth. Neither the cabinet or well are water tight and care must be taken to avoid spillage onto it.

WARNING: NEVER IMMERSE THE CABINET IN WATER TO AVOID SERIOUSLY DAMAGING INTERNAL PARTS.

When not in use, the unit should be stored in a clean, dry condition. Clean, dry Blocks may be left in the unit during storage if desired. The immersion thermometer together with any vessels or test tubes which are used in the Blocks should be removed when not in use and stored separately.

8. Trouble-Shooting

There are very few malfunction problems with equipment such as this Incubator. The lack of complexity and small number of working parts makes diagnosis and repair of problems easy. The observed problems and their probable causes are:

PROBLEM	CAUSE
1. The heater lamp will not light and the unit will not heat.	A. The unit is not plugged in or it is not plugged into a proper, working outlet (check the outlet). B. The power switch is "OFF".
2. The heater lamp is flickering but the unit will not heat to the desired level.	A. The temperature control knob for the range selected is set too low (turn clockwise). B. Wrong range selected (select again). C. Faulty thermostat (replace).
3. The heater lamp is lit but not flickering; the unit is not hot.	A. Give it more time to heat up. B. Wrong range selected (select again). C. Faulty heater (replace).
4. Temperature is too high or too low and will not change when temperature control knob is turned.	A. Wrong range selected on the power switch (reset power switch). B. Faulty thermostat (replace).
5. The heater lamp flashes intermittently every 5 to 60 seconds.	A. No problem. The unit is turning itself on and off to maintain constant temperature.

9. Repair and Replacement

Repair of the Incubator is confined to checking for loose electrical connections or replacement of faulty components. It is not recommended that repair of faulty components be attempted.

CAUTION: THE UNIT MUST BE DISCONNECTED FROM THE POWER SOURCE PRIOR TO SERVICING. IT IS RECOMMENDED THAL ALL SERVICE BE PERFORMED BY QUALIFIED PERSONNEL.

All repairs and parts replacements are done from the inside of the unit. Access to the interior requires the separation of the lower body from the upper body of the unit. By turning the incubator upside down you can remove four screws from the bottom. Remove two screws from the top edge of the back as well. This physically separates the upper and lower body portions. [NOTE: Before separation, be sure to remove the Temperature Control Knobs by loosening the set screws holding them to the thermostat shafts.] You may then pull downward on the back of the lower body and slide the lower body forward over the protruding shafts of the thermostats. Separation is now complete and the interior is exposed.

A. Power Selector Switch

1. Depress four spring clips holding the switch in the panel and push the switch out through the opening in the panel without removing the wire connections.

2. Physically orient the new Switch to match the old one and change the wire connections from the old switch to the new one. Change one wire at a time being sure to connect it to its proper terminal on the new switch.

3. After all wiring connections are completed, depress the spring clips on the new switch and carefully insert it through the front panel until it snaps securely in place.

B. Heat Light (RED)

Replacement procedure is identical to that for the Power Switch except that only two wiring connections are required.

C. Heater Plate Assembly

The heating element is permanently bonded to the heater plate and must be treated as an assembly. To determine if a Heater needs to be replaced, check the integrity of the heating elements by measuring their resistance. Using an ohmmeter, read the total Heater resistance. Disconnect the wiring connections to the Heater and with the ohmmeter connected to the leads "1" and "2", a value of approximately 135 ohms should be obtained. (When the Heaters are COLD).

If the heating elements are broken, an infinitely high resistance will be indicated. When this occurs, the Heater must be replaced as follows:

1. Remove the four screws holding the Heater Plate Assembly to the body. Disconnect the heater lead wires.

2. Remove thermostats from the front edge of the heater plate by removing screws, nuts and lock washers. Note: Be careful to note physical orientation of thermostats with respect to heater plate so that they may be replaced properly in new heater plate.

3. Mount thermostats on new Heater Plate Assembly by reversing procedure in (2) above.

4. Mount new Heater Plate Assembly using screws removed in (1) above.

5. Re-connect heater lead wires.

D. Thermostats (High or Low)

For access to thermostats, the Heater Plate Assembly must be removed as previously described.

1. Remove screw, nut and lock washer holding the thermostat to the front edge of the Heater Plate Assembly.

2. Remove two slip-on wire connections from faulty thermostat.

3. Place wire connections on new thermostat.

4. Mount new thermostat being careful to orient it physically identical to the old one.

E. Voltage Selector Switch

This switch is located on the back panel of the Incubator body. Special care must be exercised during its replacement since wiring connections are soldered. Only qualified personnel capable of making such connections should attempt switch replacement.

1. Remove (2) screws and nuts holding the switch to the back panel.

2. Remove soldered connections from old switch. Note: retain short "jumper wire for use on new switch.

3. Add "jumper wire to new switch and replace all other connections with soldered connections. Note: Be sure to closely follow Wiring/schematic Diagram included in this manual for proper location of all connections.

10. Storage

Short term storage between periods of use has been covered under the "Equipment Care" section of these instructions.

For long-term storage, prior to initial use of the unit, it is recommended that it be kept in its original shipping container. This will provide the maximum protection possible.

If multiple units are to be stored at one location, the shipping containers may be stacked to a maximum height of six units.

Storage indoors is certainly preferred. If short term outdoor storage is unavoidable, protection must be provided against rain, snow and freezing temperature.

11. Warranty

Boekel warrants products manufactured by Boekel to be free from defective material and workmanship for one year from the date of shipment by Boekel. The liability of Boekel for any defective equipment during the warranty period shall be limited to the repair of such equipment or replacement thereof without charge for parts or labor. Boekel shall be so liable only if Boekel receives written notice of such defect within thirty days after its discovery.

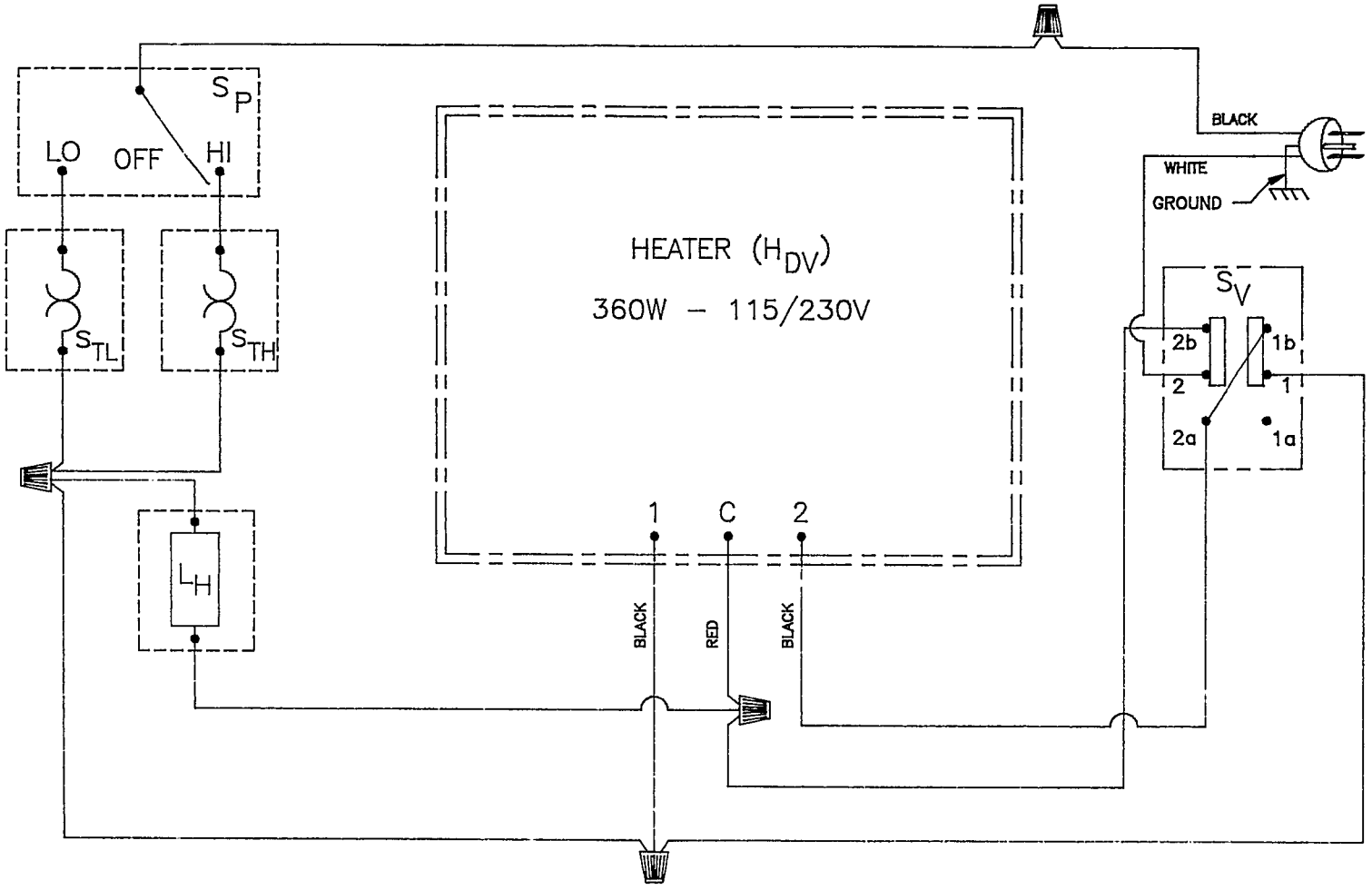
Buyer must return the defective product under warranty to Boekel after receipt of Boekel's permission to do so. This warranty does not extend to any Boekel product which has been subject to misuse, neglect, accident, modification or improper installation, or any product which has been repaired or altered by persons not expressly approved by Boekel. Boekel will not be liable for damages, loss or expense directly or indirectly arising from the use of the products or for any liability from their use either separately or in combination with other equipment or material or for any other cause.

PARTS LIST

	DESCRIPTION	QTY./UNIT	PART NUMBER	SYMBOL
1.	Power Selector Switch	1	919-0007	Sp
2.	Heater Light (RED)	1	918-0009	L_H
3.	Thermostat (LOW)	1	926-0007	S_{TL}
4.	Thermostat (HIGH)	1	926-0008	S_{TH}
5.	Voltage Selector Switch (115/230V)	1	919-0013	Sv
6.	Heater Plate Assembly, 360W (115/230V)	1	C-001031	H_{DV}
7.	Control Knob	2	923-0010	Ck
8.	Block Extractor	1	11096	(N/A)
9.	Block; 16mm, 12 place	3	110416	(N/A)
10.	Block; 13mm, 12 place	2	110413	(N/A)

ACCESSORY LIST

A.	Block; 6mm, 30 place	A/R	110006	(N/A)
B.	Block; 10mm, 20 place	A/R	110010	(N/A)
C.	Block; 13mm, 20 place	A/R	110013	(N/A)
D.	Block; 20mm, 8 place	A/R	110020	(N/A)
E.	Block; 25mm, 6 place	A/R	110025	(N/A)
F.	Block; COMBINATION 25mm, 3 place 13mm, 5 place 6mm, 6 place	A/R	110035	(N/A)



LEGEND

MOUNTS ON
FRONT PANEL

MOUNTS ON
BACK PANEL

ATTACHED TO
HEATER PLATE

SCHEMATIC / WIRING DIAGRAM